NASA HRP	INDIVIDUALIZED REAL-TIME NEUROCOGNITIVE ASSESSMENT TOOLKIT FOR SPACE FLIGHT FATIGUE	COGNITION

Principal Investigator

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Description

Human exploration of space requires astronauts to maintain a high level of effective cognitive performance in the presence of a range of fatigue-related conditions associated with perturbations of sleep and circadian neurobiology, excessive cognitive and physical workloads (e.g., EVAs), and environmental stressors (e.g., CO2, hypoxia, radiation). It is unknown to what extent fatigue is a result of (or interacts with) other occult neurobehavioral risks in space flight (e.g., reports of cognitive space fog; symptom reports of neurasthenia; visual field deficits from papilledema and/or the possibility of elevated intracranial pressure [ICP] in space). Given the breadth of neurocognitive functions required for effective performance in space, the need to medically manage sleep and fatigue in space, the very limited neurocognitive assessment tools currently in space flight, and the often anecdotal nature of cognitive complaints from space flight, there is a critical need for rapid objective assessment of a range of neurocognitive performance functions in space flight. This project will achieve this goal by developing a much-needed practical, yet comprehensive cognitive test battery, validating its sensitivity to fatigue and fatigue countermeasures, determining astronaut norms for the test battery, and establishing space-flight feasibility of the battery. The result will be a software-based Neurocognitive Assessment Toolkit for Spaceflight (Cognition) that permits rapid, real-time measurement of astronaut cognitive performance across a much broader range of neurocognitive functions than can be currently assessed in space.

Objectives

Test feasibility of Cognition administration and data acquisition in N=6 astronauts on the ISS.

Relevance

Given the breadth of neurocognitive functions required for effective performance in space, the need to medically manage sleep and fatigue in space, the very limited neurocognitive assessment tools currently in space flight, and the often anecdotal nature of cognitive complaints from space flight, there is a critical need for rapid objective assessment of a range of neurocognitive performance functions in space flight. This project will achieve this goal by developing a much-needed practical, yet comprehensive cognitive test battery, validating its sensitivity to fatigue and fatigue countermeasures, determining astronaut norms for the test battery, and establishing space-flight feasibility of the battery. The result will be a software-based Neurocognitive Assessment Toolkit for Spaceflight (Cognition) that permits rapid, real-time measurement of astronaut cognitive performance across a much broader range of neurocognitive functions than can be currently assessed in space. In addition, because of its potential breadth of computerized neurocognitive assessments, the brevity of its evaluation, and its validity for sensitivity to fatigue, Cognition would be of considerable interest for a wide range of situations on Earth in which there is a need to determine the extent to which someone is cognitively compromised by fatigue and in need of a countermeasure.

BDC Summary

Subjects will perform the Cognition battery (all 10 tests) 1 time during familiarization at JSC, 3 times pre-flight (L-90, L-60, L-10), and 3 times post-flight (R+10, R+60, R+90). There is some flexibility in this schedule. Each test session is expected to require 20-30 minutes total time which includes time to launch and close out the Cognition software. The Cognition battery should be performed with as little distraction as possible. Consumption of caffeine and medications potentially influencing performance will be surveyed in the software briefly prior to the start of each test battery. This test should be performed in the evening within 2 hours of going to bed. The Cognition software will be loaded on the subject's NASA-provided laptop, and the laptop will be calibrated during the familiarization session.

In-flight Operations Summary

Cognition will be performed on the Human Research Facility (HRF) Portable Computers (PCs) 11 times in-flight. Crewmembers of standard duration will perform tests on the following days: 4 times early in-flight with a 1-week interval (FD 6, 13, 20, 27), 7 times later in-flight at 19-day intervals (FD 46, 65, 84, 103, 122, 141, 160). Crewmembers of extended duration will perform tests on FD 6 and subsequent tests will be performed at 34 day intervals. There is some flexibility in this schedule. Consumption of caffeine and medications potentially influencing performance will be surveyed in the software briefly prior to the start of each test battery. This test should be performed on the same SSC each time and in the evening within 2 hours of going to bed.

Subject Selection/Participation Criteria

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None.		